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Earth Observation data and knowledge preservation at ESA

from bit archiving to Earth Science long term applications

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ESA - Earth Observation Programmes

e-IRG - User needs in IT and Information Infrastructure
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eesa **Summary**

- ✓ The Earth Science world and Earth Observation capabilities
- ✓ EO operational scenarios
- ✓ EO archiving, preservation and exploitation issues

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eesa **The Earth Science world**

Coupled and inter-disciplinary processes

Complex web of sensor

Complex data analysis

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eesa **Earth Observation potential**

GOME total ozone assimilation

10 y displacement of Etna 1992-01

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eesa **More Earth Observation potential**

ROMA

ERS radar derived imagery: 10 y changes in ground stability

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eesa **European EO space capacity**

1990 2000 2004 2010

Meteo
METEOSAT M-1, 2, 3, 4, 5, 6, 7 → METEOSAT Second Generation MSG-1, -2, -3
in cooperation with EUMETSAT

Science
CryoSat (Polar Ice Monitoring)
GOCE (Gravity and Ocean Circulation Explorer)
ADM/Aeolus
SMOS
Earthcare
SWARM
For a better comprehension of the Earth System

Application Services
ERS-1, -2 → ENVISAT
Earth Watch
Systems part of Global Monitoring for Environment and Security (GMES), in cooperation with EC
Long term environment monitoring

European users
Earthnet: European access to non-ESA missions: Landsat, SeaWiifs, NOAA, JERS, MODIS, ALOS, Proba, Bird, Scisat...

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eesa The Earth Observation operation scenario

✓ Wide distributed system environment:
- multi-satellites
- multi-facilities

A decentralized ground segment

- Flight Operations Control Centre (FOCC) at ESA/ESOC
- Payload Data Control Centre (PDCC) at ESA/ESRIN
- NRT Processing Stations (PONS) at ESRIN and Kosmos
- DF-Line Processing and Archiving Centre (PAC) in 7 European countries

✓ Large user community
- multi-discipline
- research, institutional, commercial and operational
- Large international partnership

ERS SAR Image Mode Ground Station Coverage

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eesa Some Earth Science digital data requirements

- ✓ Global, regional, local applications
 - Alternative use of the data at different resolution
- ✓ Large historical distributed archives
 - Long term data and knowledge preservation issues
- ✓ Near real-time access to data
 - For processing, value adding and dissemination
- ✓ Integration with models to provide long term trends and forecast
 - Data assimilation
- ✓ Integrate different data sources
 - Standardisation, Virtual Organisation, ...
- ✓ Need to link data to technical information and scientific results
 - Need to keep/transfer the historical Knowledge

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eesa The near future perspective: GMES

Needs

- Space observing systems
- In-situ observing systems
- User oriented services

Solutions

- Data integration & information management
- models
- documents

Earth Scientists
Governments
EU International Organisations
Regulatory Bodies
Industry
General Public

<http://www.gmes.info>

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eesa A GMES example: Marine & Coastal Management

EMSAs, EU DGs, EEA, Int'l conventions secretariats (OSPAR, Helsinki, MAP)

Coast guards, Port authorities, Coastal Environment managers, Environment agencies, Health & safety agencies, Food/fisheries agencies

Systematic monitoring and detection for ALERT, Decision support information, Reference DB administration, Coastal Management information

Airborne surveillance operators, AIS, VDS, VTMS operators, NRT radar imagery, NRT optical imagery, Meteo forecast, Ocean state forecast, In-situ data collection networks

Documents/knowledge, Satellite operators, Meteo models operators, Ocean model operators, Documents/knowledge

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eesa GEOSS – the wider view
Global Earth Observation System of Systems

INTEGRATED

- Synoptic systems
- Air-based systems
- Space-based systems
- Earth-based systems
- Space-based systems

Data Management System

Human Health & Well-being, Natural & Human Induced Disturbance, Air Quality, Atmospheric, Environmental & Terrestrial, Energy Resources, Water Resources, Ocean Turbidity & Climate, Environmental Quality & Governance, Agricultural, Forest & Marine Resources, Biodiversity

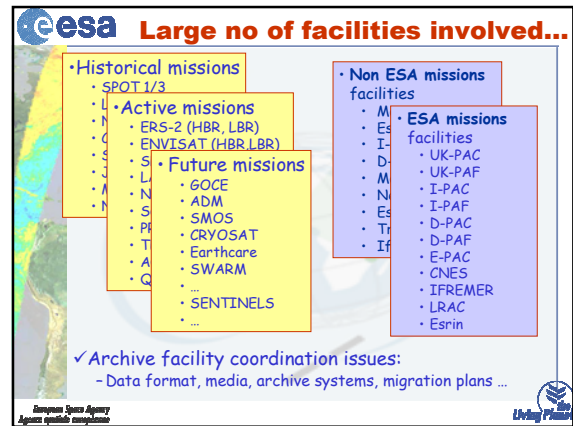
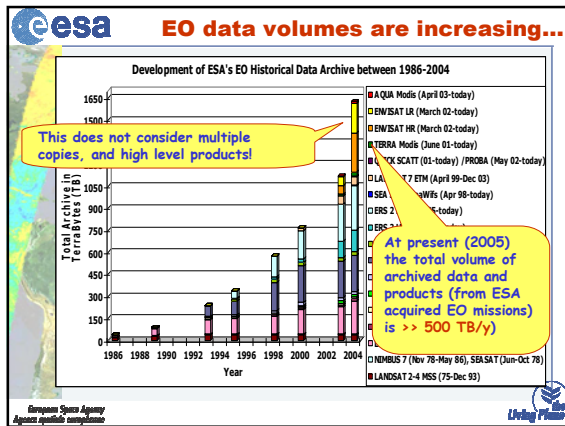
The interoperability framework

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eesa The EO infrastructure issues

- ✓ Bring together in the virtual organisation
 - the users: scientists, institutions ...
 - the space data providers: acquisition stations, processing and archiving facilities
 - the other data providers
- ✓ Access services ... not simple data
 - Interoperability issues
- ✓ Need for linking all available expertise and knowledge in data handling/usage

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- ### Some data archiving issues...
- Volume of data to be archived are exponentially increasing
 - At present, ESA mandate is to maintain archives for 10 years only after mission end of life
 - For a missions like ERS-1, this period is already over.
 - ESA is proposing a coherent technical and managerial strategy
 - through Ground-segment coordination body with CNES, ASI, DLR, EUMETSAT...
 - coordination efforts started with some practical results
 - The long-term funding strategy is to be found
 - Space agencies use the funds from other on-going programme to maintain these historical datasets
 - Such a scheme is no sustainable on the long-term


- ### Some data preservation issues...
- Data integrity is not coherent across missions / facilities
 - Archive evolution - data migration on routine basis, format definition, media maintenance, technology evolution, security, etc.
 - Completeness - Integration of the physical telemetry payload data as acquired by at the stations with the related ephemeris (orbit...), auxiliary data (processing info to generate the nominal products...)
 - Logistic - where the data are physically stored (processing may be performed in a separate location if required)
 - access - information on what is archived and how to retrieve data (metadata, browse, products generation capability, products dissemination, local infrastructure, data reprocessing, etc.)

- ### Some archive exploitation issues
- Provision of reference consolidated data sets...
 - Systematic and periodical global dataset generation
 - Assimilation / integration processes (fill the gaps)
 - Science user support and acceptance
 - Technical issues: e.g. standards
 - On-demand access to simple and complex products
 - Evolution of archive access
 - Evolution of data processing algorithms
 - ...
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- ### Actions taken for an European coordinated approach
- The ESA strategy is based on principles defined in
 - In agreement with ESA Delegation boards (DOSTAG, PB-EO)
 - PB-EO Ground Segment Task Force recommendations
 - Coordination started at ESA + National facilities via the G/S Coordination Group
 - Common archive standards (SAFE)
 - Define common data model (OAIS) and operational procedures
 - Standardization of interfaces
 - ...

 **Benefits for an European coordinated approach**

- ✓ Cost reduction in terms of implementation and operations of existing and future projects
 - easier data exchange (based on same standards)
 - Better services to users
- ✓ Stronger European position at International level
 - Medium and Long term harmonized European data preservation policy
 - Leading voice in International Organizations, support coordinated approach also for *GMES* and *GEOSS*
- ✓ Optimal definition of infrastructure for common approach to data and knowledge preservation in Earth Science
 - Easier share of Facilities and related infrastructure
 - Ensure preservation of historical data, after the end of the mission lifetime

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 **Thank you!**

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